Prior Art

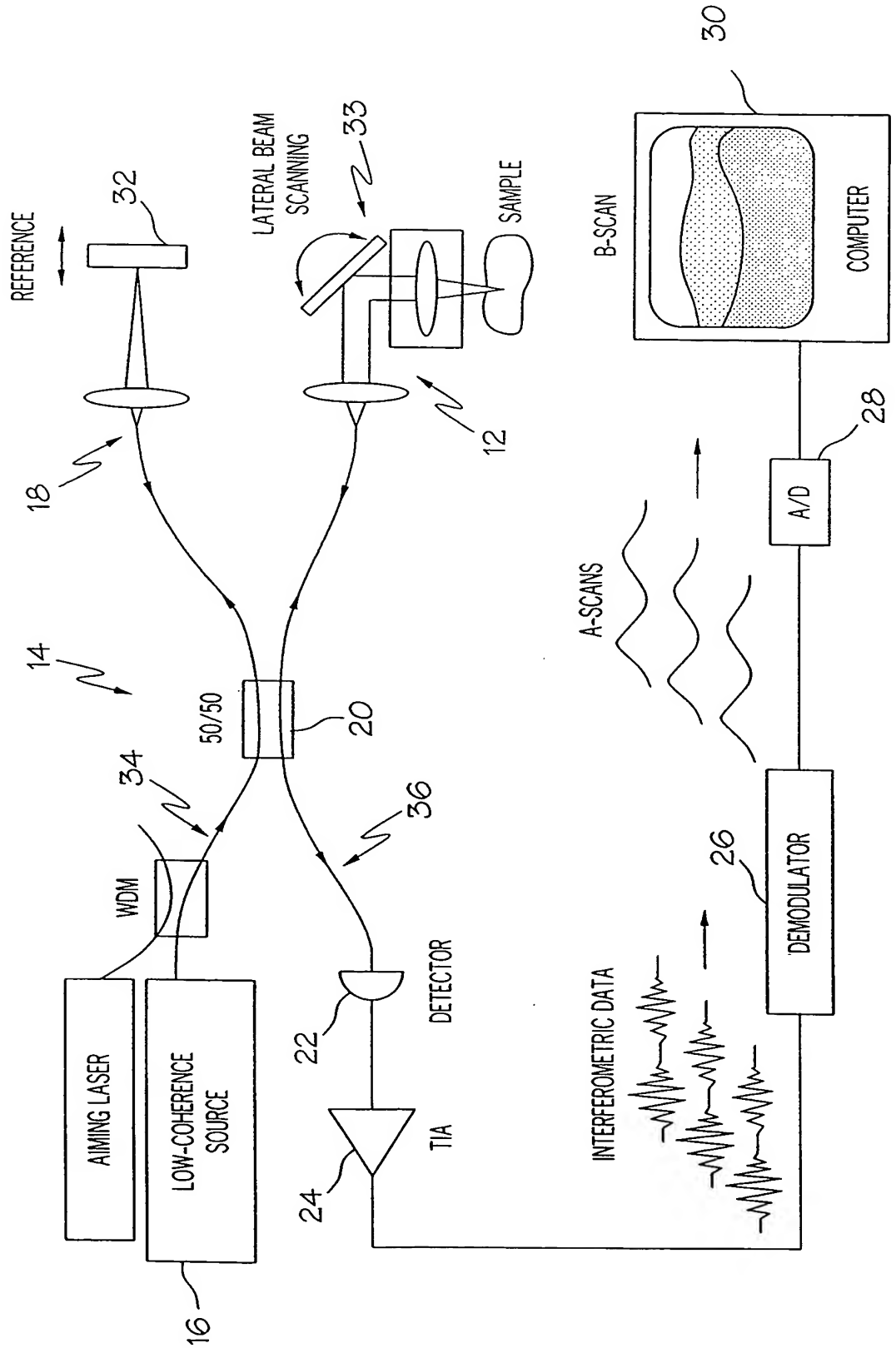
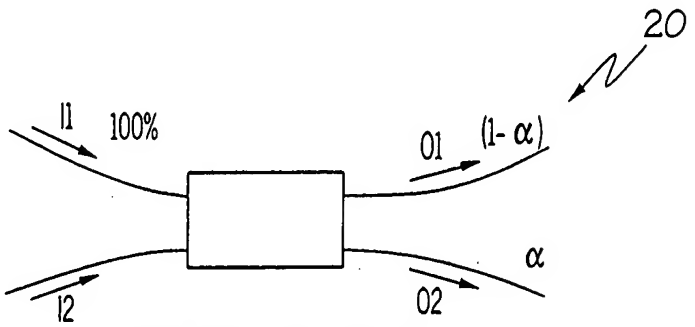
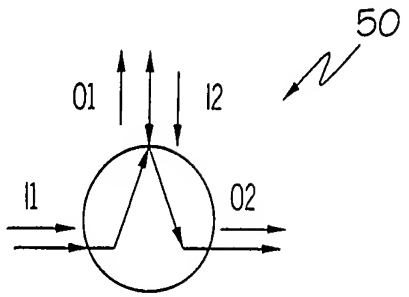


FIG. 1



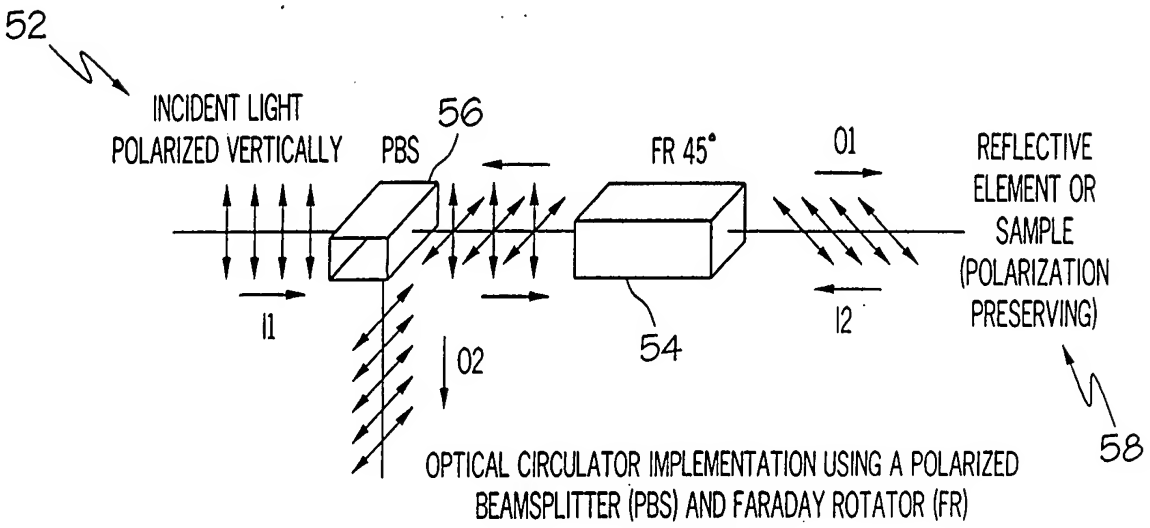
BEAMSPLITTER/FIBER COUPLER

FIG. 2
Prior Art



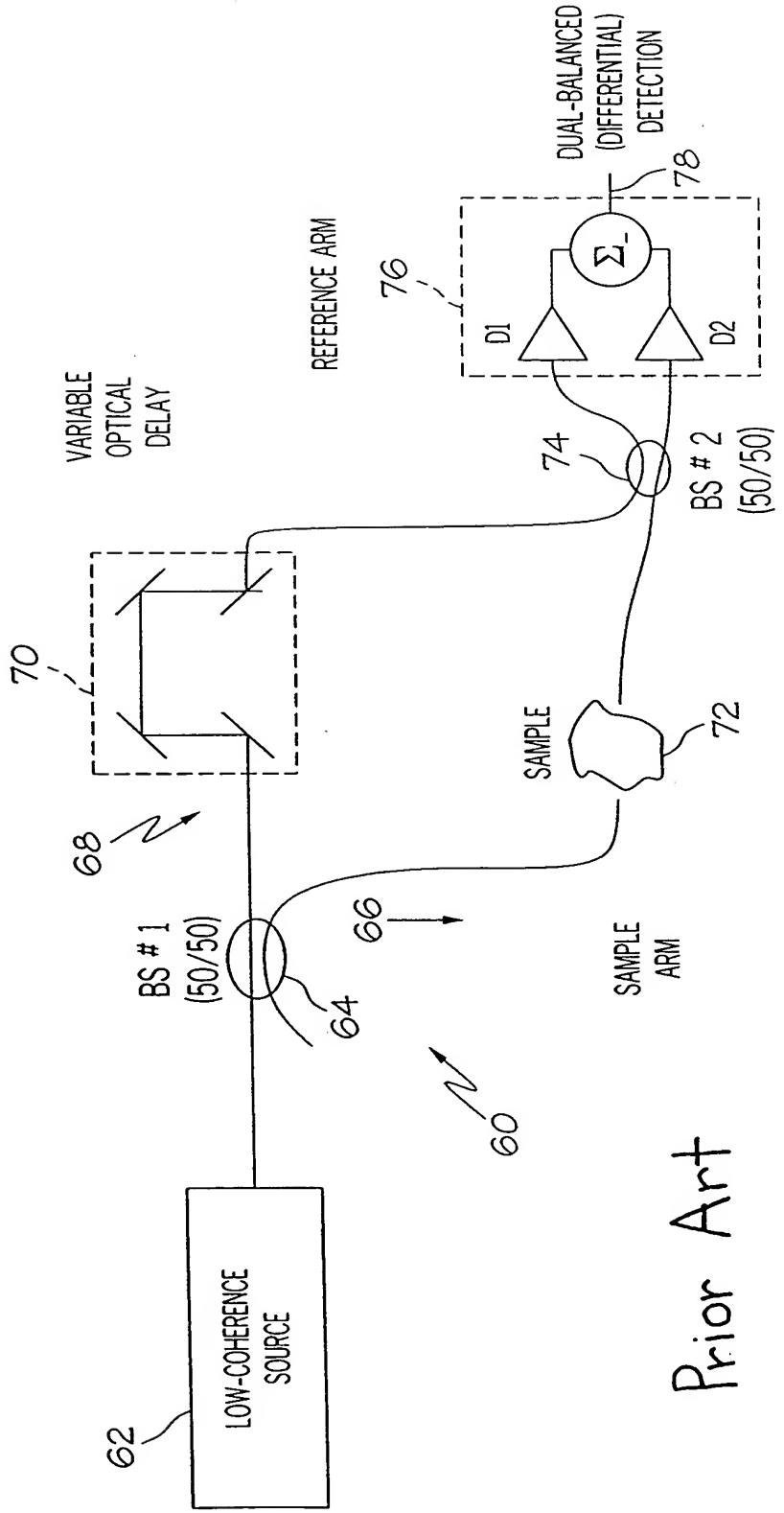
OPTICAL CIRCULATOR

FIG. 3
Prior Art



OPTICAL CIRCULATOR IMPLEMENTATION USING A POLARIZED BEAMSPLITTER (PBS) AND FARADAY ROTATOR (FR)

FIG. 4
Prior Art



Prior Art

MACH-ZENDER (TRANSMISSIVE) OCDR/OCT

FIG. 5

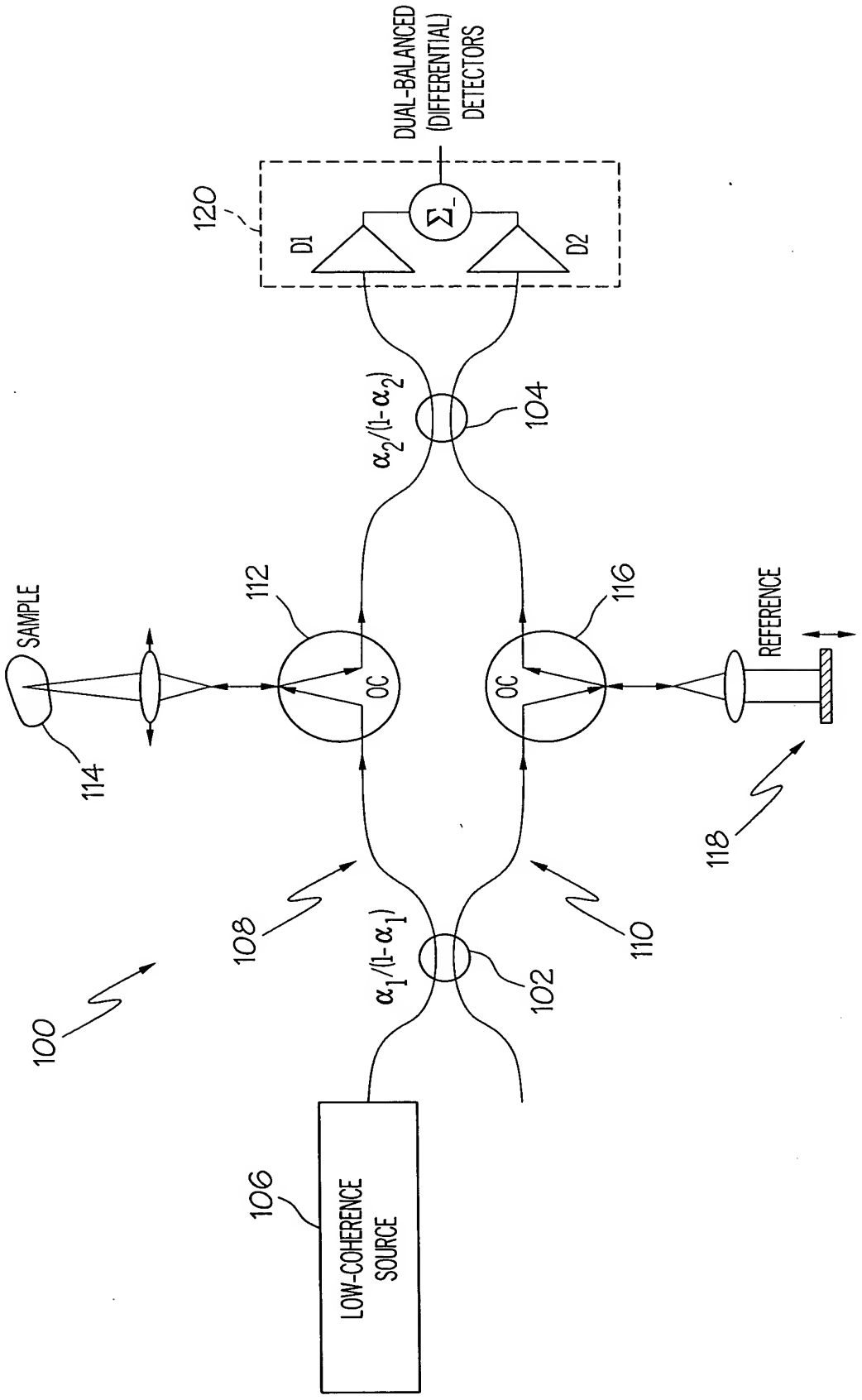

DUAL-BALANCED
(DIFFERENTIAL)
DETECTORS
120
D1
D2
Σ-
$\alpha_2/(1-\alpha_2)$
104
SAMPLE
112
116
REFERENCE
OC
OC
114
118
108
110
$\alpha_1/(1-\alpha_1)$
102
100
106
LOW-COHERENCE
SOURCE

FIG. 6

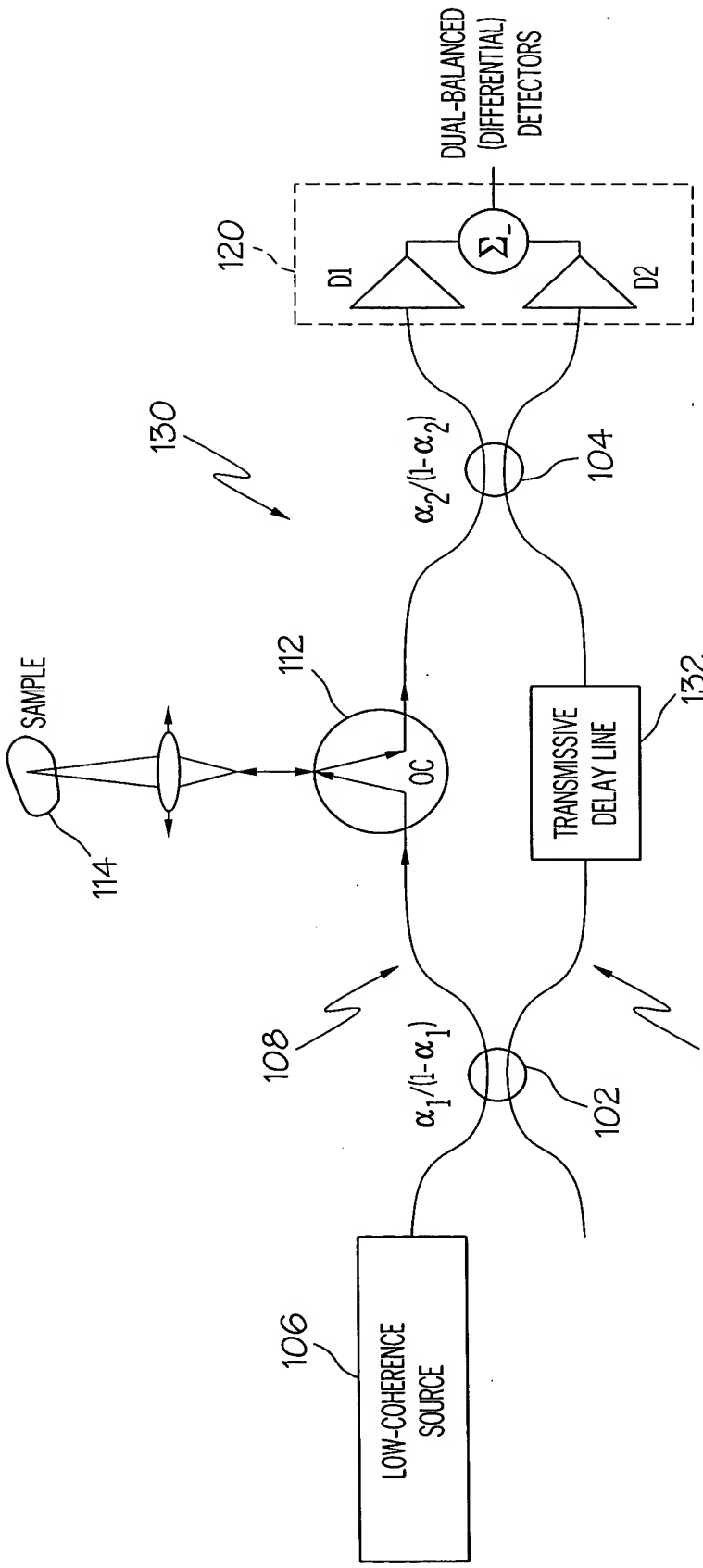

DUAL-BALANCED (DIFFERENTIAL) DETECTORS
120
D1
D2
Σ-
130
$\alpha_2/(1-\alpha_2)$
104
SAMPLE
112
OC
TRANSMISSIVE DELAY LINE
132
114
108
$\alpha_1/(1-\alpha_1)$
102
110
106
LOW-COHERENCE SOURCE

FIG. 7

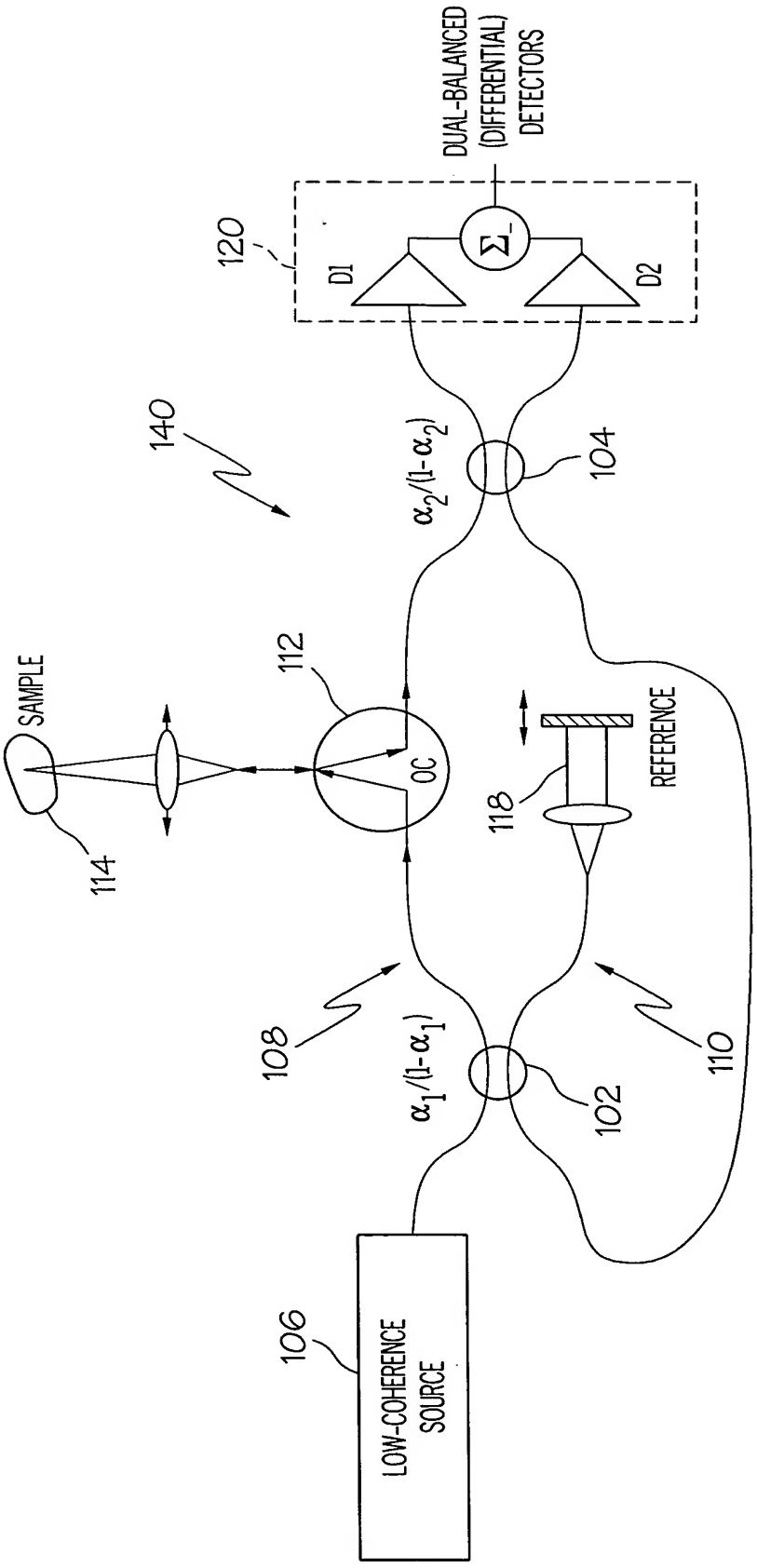

DUAL-BALANCED
(DIFFERENTIAL)
DETECTORS
120
D1
D2
Σ-
140
$\alpha_2/(1-\alpha_2)$
104
SAMPLE
112
OC
REFERENCE
118
114
108
$\alpha_1/(1-\alpha_1)$
102
110
106
LOW-COHERENCE
SOURCE

FIG. 8

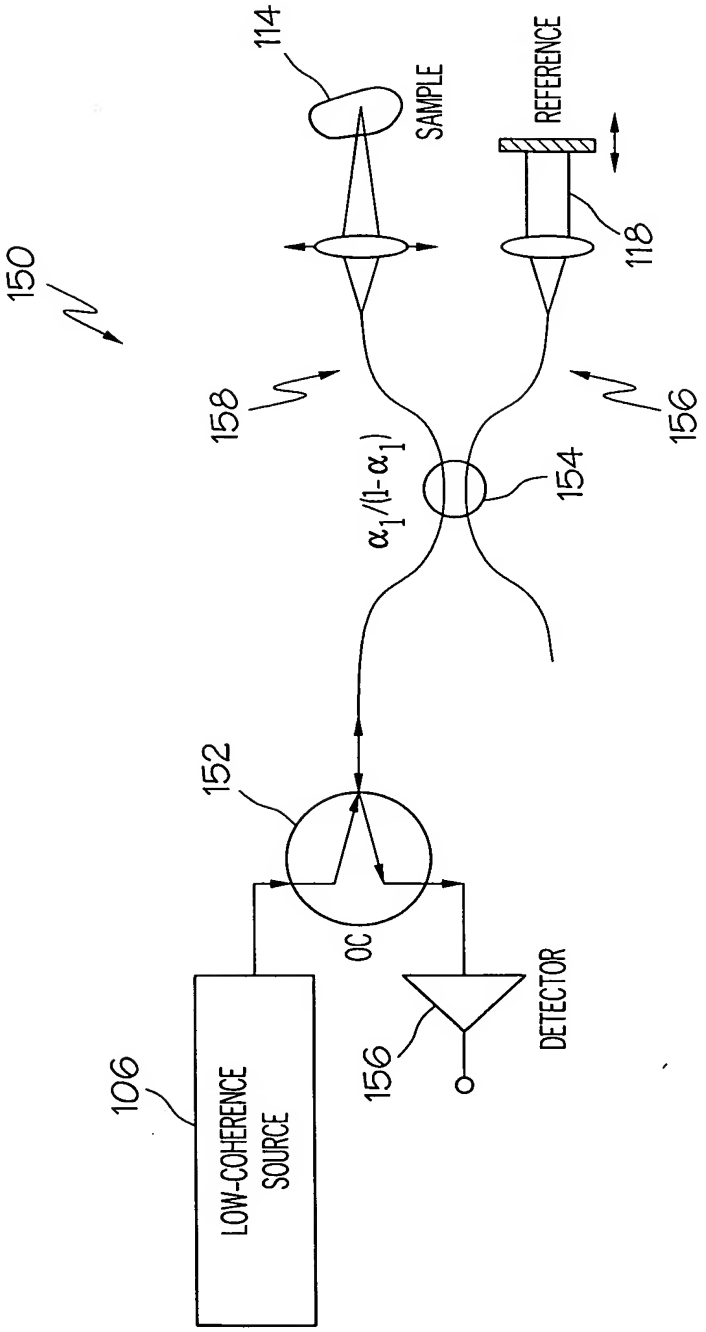

150
114
SAMPLE
REFERENCE
118
158
156
$\alpha_1/(1-\alpha_1)$
154
152
OC
106
LOW-COHERENCE SOURCE
156
DETECTOR

FIG. 9

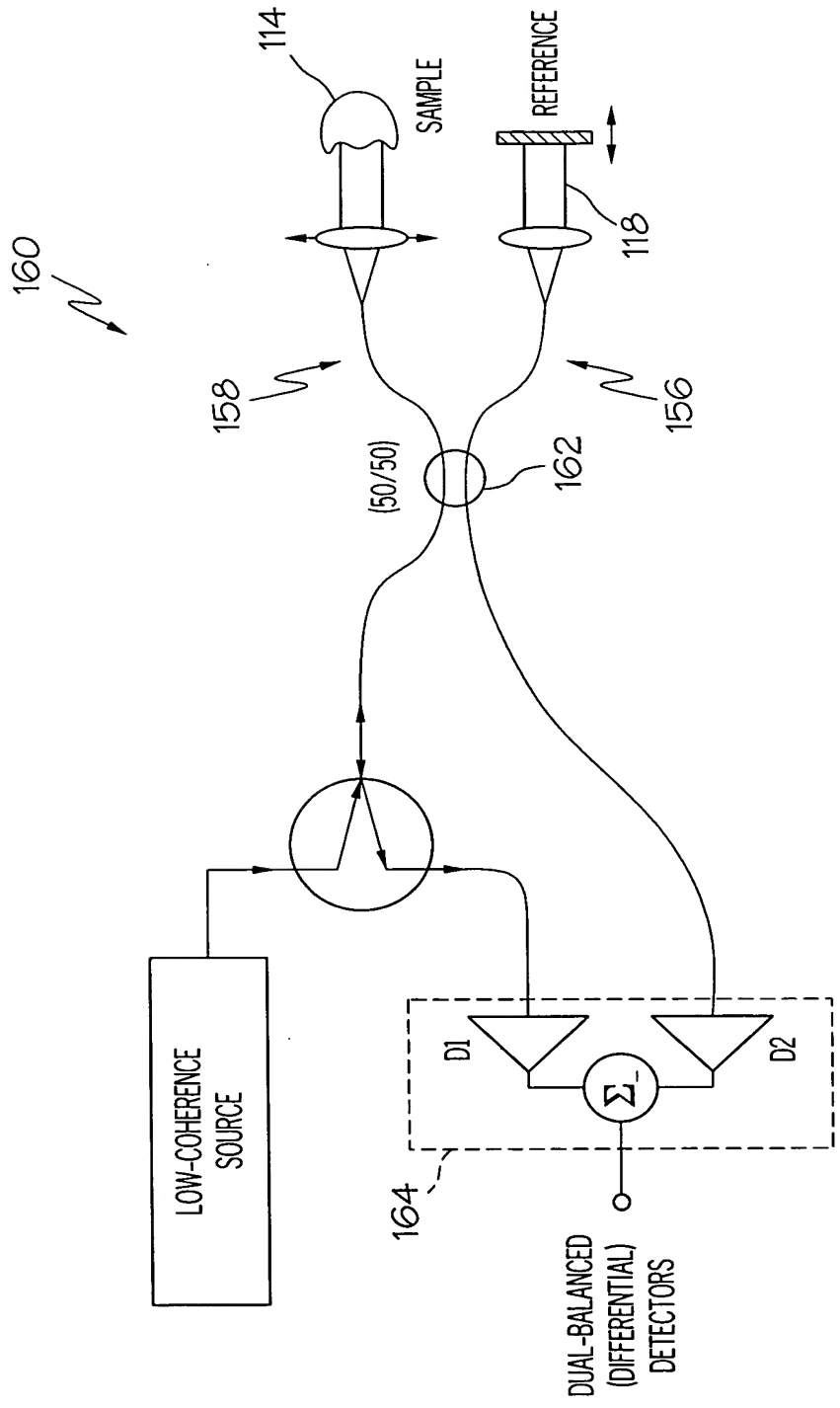
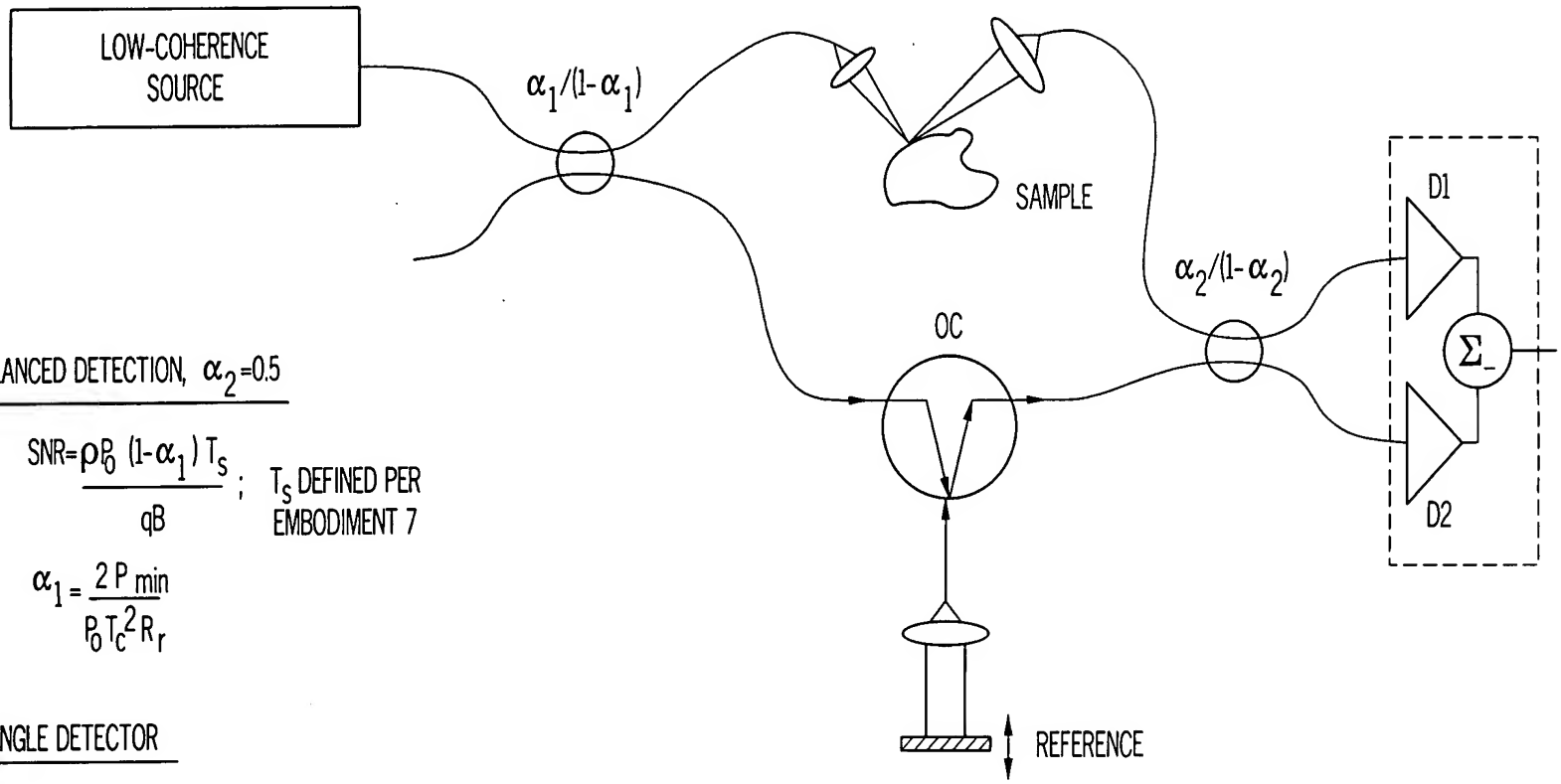

160
114
SAMPLE
REFERENCE
118
158
156
(50/50)
162
LOW-COHERENCE SOURCE
D1
D2
Σ_
164
DUAL-BALANCED (DIFFERENTIAL) DETECTORS

FIG. 10



BALANCED DETECTION, $\alpha_2=0.5$

$$SNR=\frac{\rho P_0 (1-\alpha_1) T_s}{qB}$$; T_s DEFINED PER EMBODIMENT 7

$$\alpha_1 = \frac{2 P_{min}}{P_0 T_c^2 R_r}$$

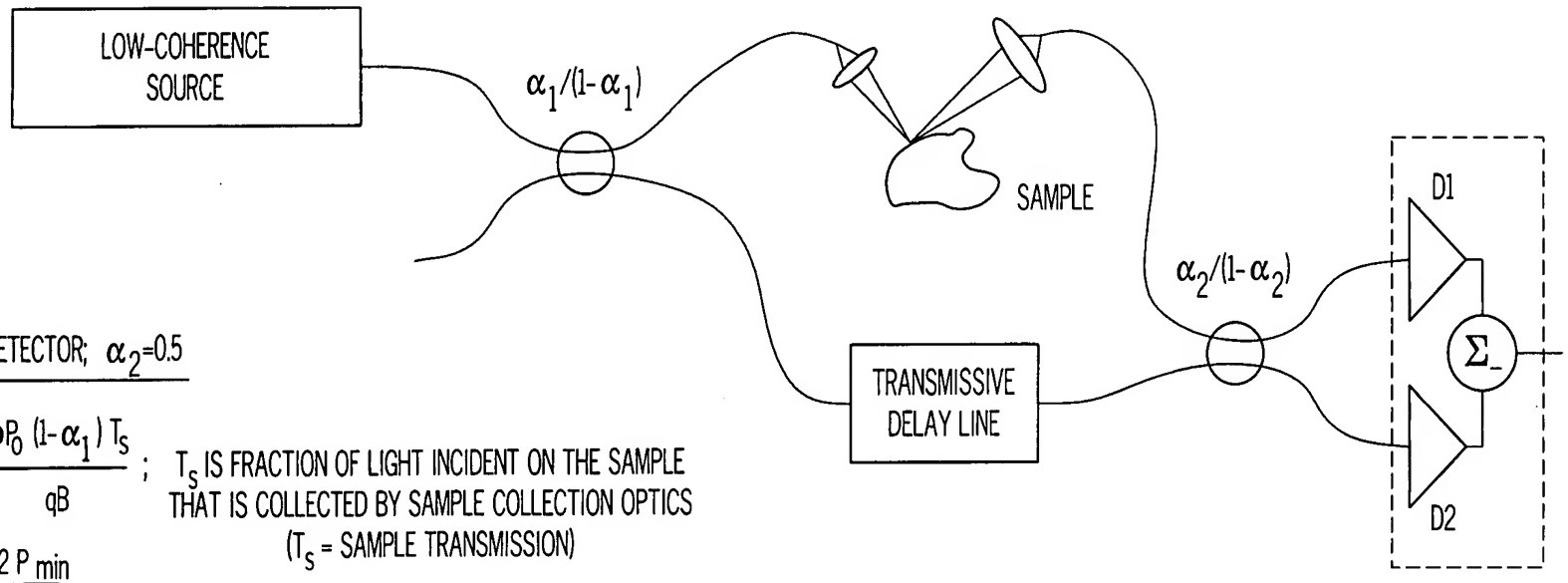
SINGLE DETECTOR

$$SNR=\frac{\rho P_0 (1-\alpha_1)(1-\alpha_2) T_s}{qB}$$

$$\alpha_1 \alpha_2 = \frac{P_{min}}{P_0 T_c^2 R_r}$$

IF $\alpha_1 = \alpha_2$, $\alpha_1 = \alpha_2 = \sqrt{\frac{P_{min}}{P_0 T_c^2 R_r}}$

FIG. 11
(EMBODIMENT 6)



BALANCED DETECTOR; $\alpha_2=0.5$

$$SNR=\frac{\rho P_0 (1-\alpha_1) T_s}{qB}$$; T_s IS FRACTION OF LIGHT INCIDENT ON THE SAMPLE THAT IS COLLECTED BY SAMPLE COLLECTION OPTICS (T_s = SAMPLE TRANSMISSION)

$$\alpha_1 = \frac{2 P_{min}}{P_0 T_r}$$

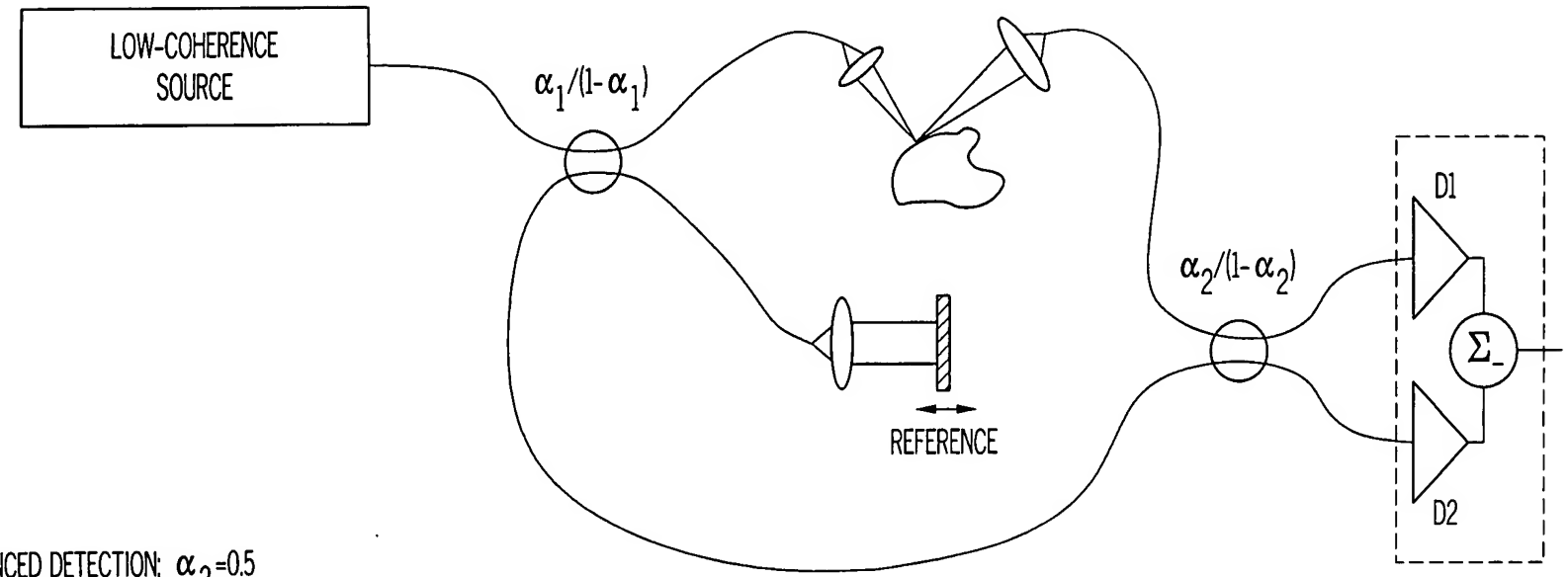
SINGLE DETECTOR

$$SNR=\frac{\rho P_0 (1-\alpha_1)(1-\alpha_2) T_s}{qB}$$

$$\alpha_1 \alpha_2 = \frac{P_{min}}{P_0 T_r}$$

ASSUME $\alpha_1 = \alpha_2$, $\alpha_1 = \alpha_2 = \sqrt{\frac{P_{min}}{P_0 T_r}}$

FIG. 12
(EMBODIMENT 7)



BALANCED DETECTION; $\alpha_2 = 0.5$

$$SNR = \frac{\rho P_0 (1-\alpha_1) T_s}{qB}, \quad \alpha_1 \cong \frac{2\,Pmin}{P_0 R_r}, \quad \text{ASSUMING SMALL } \alpha_1$$

SINGLE DETECTOR

$$SNR = \frac{\rho P_0 (1-\alpha_1)(1-\alpha_2) T_s}{qB}, \quad \alpha_1 (1-\alpha_1)\, \alpha_2 = \frac{Pmin}{P_0 R_r}$$

ASSUME $\alpha_1 = \alpha_2$, $\alpha_1 = \alpha_2 \cong \sqrt{\frac{2\,Pmin}{P_0 R_r}}$, ASSUMING SMALL α_1 AND α_2

FIG. 13
(EMBODIMENT 8)